SOILutions

VOL 2, NO 3 FALL 91

Published Quarterly by Plant Industry Division's SOILS BRANCH

FALL-APPLIED NITROGEN, Pros and Cons

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We are frequently asked about the relative effectiveness of fall versus spring nitrogen fertilizer applications. In a nutshell, fall fertilization can range from very effective to disastrous depending on soil moisture, the form of nitrogen used and how it is applied. Let's start with a quick review of the fate of fertilizer N in soil.

Fertilizer N is applied to soil in the form of urea ($CO(NH_2)_2$), anhydrous ammonia (NH_3), ammonium (NH_4^+), or nitrate (NO_3^-) depending on the product used. Urea and anhydrous ammonia quickly convert to ammonium . It is the ammonium and nitrate forms that are taken up by plants. If the soil is warm, moist and well aerated, ammonium is rapidly oxidized to nitrate through the nitrification process. This is a biological process performed by highly specialized soil bacteria.

Banding slows the nitrification process by creating an environment near the band that inhibits the activity of the bacteria converting ammonium to nitrate. Therefore, if urea or anhydrous ammonia is banded in late fall, most of the N is retained in the ammonium form until the soil warms up in the spring. If the fertilizer is broadcast or banded in early fall, most of the ammonium will be converted to nitrate prior to freeze-up. Twenty years of research in Alberta has shown that if fall-applied N is converted to nitrate prior to freeze-up, large losses can occur when soils are water saturated during and just after snow melt in early spring. The losses are caused

Contiuned Page 2

SUBSOILING LUVISOLIC SOILS

Jerome Lickaz
Soils Branch

Widespread acceptance of subsoiling as an amelioration technique for Solonetzic soils has prompted farmers to inquire if this same technique would improve yields on Luvisolic (Gray Wooded) soils. Much like the Solonetzic soils, Luvisols have a clay enriched subsurface layer. Subsoiling has the potential to fracture this Bt horizon and thus promote greater water infiltration and root growth.

Comments from farmers who have ripped soils in the higher rainfall areas indicate that harvesting is easier during wet falls and that deeper and more rapid moisture infiltration generally improves trafficability. However, these comments apply after the soil has had a chance to settle. Many farmers have reported some difficulties in working fields in the first year after subsoiling because of poor trafficability.

Soils Branch has a research project underway aimed at identifying which soils, if any, are most likely to respond to subsoiling. We have from 1 to 3 years of data from a series of plots running from Rimbey in the south to Lac la Biche in the north. Results so far indicate that subsoiling does improve yields, but it is to soon to determine if the benefits are long lasting and the pratice economical.

Farmers interested in trying ripping on their fields should first examine their soil to see if there is evidence of restricted root penetration and slowed infiltration. Dig soil pits at several mid and top slope positions (avoid the low spots) in

Continued Page 3

THIS ISSUE:

Alberta Agriculture

Fall-Applied N as a Percent of Spring Broadcast and Incorporated

Application Method	Soil Climate Categories			
	Dry	Medium	Wet	Irrigated
Spring Broadcast and Incorp	100	100	100	100
Spring Banded	120	110	105	110
Fall Broadcast and Incorp	90	75	65	95
Fall Banded	120	110	85	110

Dry - Well drained soils which are seldom saturated during spring thaw.
Medium - Well to moderately drained soils that are occaisonally saturated during spring thaw for short periods.
Wet - Poorly to moderately drained soils that are saturated for extended periods during spring thaw.
Irrigated - Well drained soils in southern Alberta that are seldom saturated during spring thaw.
(Source: Agdex 542-7)

Fall N Cont.

by an anaerobic process called denitrification which converts nitrate to nitrogen and oxygen gases.

Research has also shown that denitrification will occur in virtually all of our agricultural soils. This is not surprising since denitrification is not a particularily specialized function. Many different types of soil bacteria use denitrification as an alternative form of respiration when oxygen is in short supply.

What this means in terms of fertilizer management is that no soil type or region of the province is 100% safe when it comes to losses of fall-applied N. The risk of over winter N loss is highest in regions with moister climates such as west central Alberta. There is less risk in regions that tend to be drier such as south eastern Alberta, but even in these regions N losses can be high during a wet spring. In general however, N losses through denitrification in the drier regions are relatively small and fall banded N is equal to spring banded N (see Table). In cases where spring banding causes a significant loss of seedbed moisture, fall banding can be superior to spring banding.

Also keep in mind that denitrifying bacteria are less than 2 millonths of a meter in size. They could care less about the regional climate or moisture level during a given spring. They only respond to what is happening in their tiny corner of your field. What does this mean? It means micro-climate is also important. Even during dry springs, there are localized wet areas such as depressions where denitrification can occur.

Think about this in terms of your own fields. Are they uniformily flat and well drained? Not likely. There are always spots that are wetter than the rest. Where runoff accumulates after a rain or spring snow melt. Over winter N losses can vary greatly over a short distance. Fall-applied N can be very effective on an upland and totally ineffective in a depression just a few yards away.

So remember fall-application always puts your fertilizer N at risk. The level of risk is generally assessed at the regional level, but whether or not losses occur is a function of very local conditions.

Before we get into the nitty gritty of management recommendations, let's use our discussion thus far to develop some general rules about application methods and timing:

- Generally spring banded is the the most effective method of application and fall broadcast the least effective.
- Fall banded N will be as effective as spring banded if there is no extended period of saturation in the spring.
- Fall banded N may be more effective than spring banded when lack of seedbed moisture is a concern.

With this information in mind here are a few tips to consider before you fertilize this fall:

★ If your soils tend to be saturated with water for extended periodsin the spring, then fall-application is probably not a good option. However, if saturated soil conditions are normally not a problem for you, then you should get results from fall banding.

★ Soil test to determine the optimum rates of fertilizer required. We encourage producers to sample 0-6, 6-12, and 12-24 inches to determine the cumulative N to two feet.

★ Apply a conservative rate, say 75% of soil test recommendation, or 75% of what you would expect to apply, if you haven't got your results back at time of application. This conservative fall rate is a hedge against such things as high soil test N levels, or low spring moisture or low crop prices. If conditions look favorable come spring additional N can be drilled with the seed. Take note however that the amount of additional N that can be drilled with small seeded crops like canola is only 10 pounds with a disk drill and 20-35 lbs with an air seeder.

★ Select a fertilizer formulation that is right for your conditions. Generally under low risk conditions such as in southern Alberta, anhydrous ammonia (82-0-0), urea (46-0-0), ammonium nitrate (34-0-0), or liquid nitrogen (28-0-0) perform equally well when fall banded. However, soils in southern Alberta tend to be alkaline and losses through ammonia volatilization can occur if the bands are too shallow or the soil is dry and cloddy.

★ Avoid the use of the nitrate containing products 34-0-0 and 28-0-0 on soils that tend to be saturated in the spring. Nitrates are subject to both denitrification and leaching losses under wet spring conditions.

★ Apply N in late fall after the soil temperature has dropped below 7 C and the nitrification process has slowed down.

★ Band don't broadcast. Banding restricts the contact between soil and fertilizer and as a result overwinter losses are lower.

As you can see there are a number of agronomic factors to consider before you go ahead and fall apply N. You may want to consult with a soil fertility specialist while you're setting up your fall fertilizer program.

Other management factors should also be considered in deciding to fall fertilize. Here are a few:

✦ Fall fertilization can improve your time management. By applying fall-fertilizer a field operation can be eliminated in the spring and allow earlier planting.

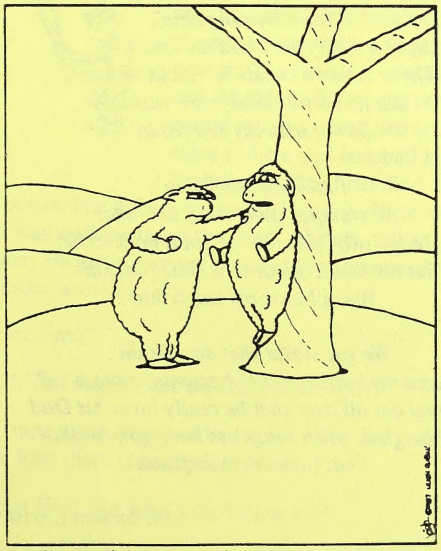
✦ Fertilizer prices and payment schedules tend to be more favorable in the fall, making it economical to fall apply.

✦ Availability of product and application equipment is often better in the fall than during the peak demand periods in spring.

✦ Soils tend to be drier in the fall, so N spplication equipment is less likely to cause soil compaction.

That covers the major points to keep in mind when making your decision to fertilize this fall. It is always a good idea to get several opinions and consider all the factors before you make your final decision. By the way, fertilizer dealers, fertilizer industry agronomists, regional soils specialists and district agriculturists are excellent sources of information, so don't hesitate to give them a call.

If you have any questions arising from this article or other aspects of soil fertility, Doug Penney can be reached in Edmonton (427-2530) and Ross McKenzie in Lethbridge (381-5126).



"Listen, pal. Can't we act domesticated about this?"

Subsoiling Cont.

the field and examine the exposed soil profile. In a Gray Luvisol you would expect to see a coarse textured ashy gray horizon just below the tillage layer underlain by a denser darker horizon that breaks out in small cubes or blocks if dry. This latter horizon is the Bt. In soil were root penetration is restricted there will be few roots growing into the Bt. Also look to see if roots are matted and growing predominantly in the horizontal direction along the top of the Bt. Slowed infiltration often causes saturation of the Ae (the ashy gray horizon) and Bt horizons. Conditions of periodic saturation will often result in the formation of mottles, a sort of rusty brown freckle on the surface of soil aggregates.

If you find evidence of restricted root penetration and slowed infiltration, the next step is to get a hold of a subsoiler and try it out. Here are a few ripping tips.

✤ Run a trial on a small area such as 20 acres with a rented or borrowed subsoiler and observe the results over a year or so before making a larger finanacial commitment such as doing the whole field.

✤ Soil conditions are important. The amelioration effect is generaly greatest when the soil is relatively dry and the implement can shatter the Bt. So after the crop is off in the fall is generally the best time to try out subsoiling

✤ A subsoiler can work to a depth of 20 inches or more and there is a real danger of ripping into a buried utility line. Alberta First Call at 1-800-242-3447 provides free location service. So call before you rip. If you hit a line with a subsoiler it's your problem or maybe your heirs.

Another approach to the problem is using legumes in rotation with cereal and oilseed crops. The benefit to crops following legumes is not only the increased nitrogen availbility, but also improved internal drainage and root penetration. The benefits from legumes can last long after the stand has been plowed down. How long? Yield data from long term research plots in the Peace River Region showed a benefit to wheat following alfalfa or alfalfa-brome mixtures 14 years after the forage stand had been plowed down. There were also measurable differences in N mineralization rates between the alfalfa or alfalfa-brome treatments and straight grass forage over the same 14 year period.

If you have questions concerning subsoiling or other aspects of soil improvement contact Jerome at 427-2530.

"I learned more about economics

from one South Dakota dust storm

than I did in all my years in college."

Hubert Humphrey (1911-1978)

FERTILIZING ERODED KNOLLS

Ross H. McKenzie
Soil Fertility Specialist, Lethbridge

Many farmers across the province have fields dotted with unproductive knolls. In many cases, water and/or wind erosion has completely stripped away the organic matter rich top soil and exposed dense compact subsoil. Infiltration of water and penetration by roots may be restricted. Air exchange may be restricted as well. The soil is poorly structured and hard to work into a good seedbed. It has a tendency to crust resulting in poor emergence and water holding capacity and infiltration are reduced making it susceptible to drought.

In addition to these physical limitations, there may be significant chemical and nutritional limitations. Loss of nutrient rich organic matter reduces the general fertility of knolls. If erosion has brought the calcareous (high lime) C horizon near the surface, the resulting high pH will also reduce the availability of phosphorus. Volatilization losses from urea or anhydrous ammonia applications will also tend to be higher due to the alkaline pH.

The best procedure for restoring the productivity of eroded knolls is a combination of phosphorous fertilizer and manure applications. Start by taking a soil sample from the knolls in your field. The P levels will likely be very low. Try an application of 75-100 lb/ac of P_2O_5. That's roughly 150-200 lbs of mono-ammonium phosphate (11-55-0 or 11-51-0), preferably banded at a depth of 3-4 inches. Fall application will make it easier to just hit the knolls, but don't leave it on the surface or it will be gone with the spring runoff. Addition of manure will also aid in amelioration of both nutrient deficiencies and tilth problems. Apply manure at a rate of 10-20 tons/ac and incorporate it.

Availability of manure may be a problem in some areas. If you can't get manure, chopped straw can be used instead. It will add some organic matter, but not much in the way of nutrients. If neither straw nor manure are available, you should still get a good response to phosphorus alone. An application of 100 lbs/ac supplemented with your usual seed placement should enhance productivity for 4-6 years.

Once phosphorus is brought up to an adequate level, watch your knolls for nitrogen deficiencies. Soil test the knolls separately and if the soil test indicates that N levels are lower than the rest of the field give them an extra shot of N.

The third part of reclaiming eroded knolls is to prevent future erosion. Increased yields from the phosphorus and manure will help by providing more stubble. But you must leave the stubble standing to protect the soil from further erosion. Options to consider are reducing or eliminating the number of tillage operations, especially fall disking, or switching from the disk to the cultivator for fall operations. If you normally bale your straw, start leaving it on the knolls.

Sound like a lot of extra trouble? Well it is, but eroded knolls are not likely to fix themselves. The bright side is that you should get a reasonable return on time and money invested from the increased productivity and have the satisfaction of leaving the land more productive than it is today.

For further information on improving productivity on eroded knolls contact your DA, regional soils specialist, Soils Branch, or Conservation and Development Branch.

I Took My Son Fishin'

I Took my son fishin',
I really felt I couldn't shirk
Those scads 'n' scads 'n' stacks of work;
But he sort a stood there wishin'--
So -- I took my son fishin'.

I took my son fishin';
We tramped all around the lake:
He got two "minnies", I got a back-ache,
But we had a great time, just "delishin",
When I took my son fishin'.

We got closer that day, fishin':
Noticed my baby boy was becomin' quite a lad --
Found out all over that he really loves his Dad.
I'll be glad, when the years have gon swishin',
That I took my son fishin'.

- Charsten Christensen

CANOLA PRODUCERS: Watch Your N:S Balance!!

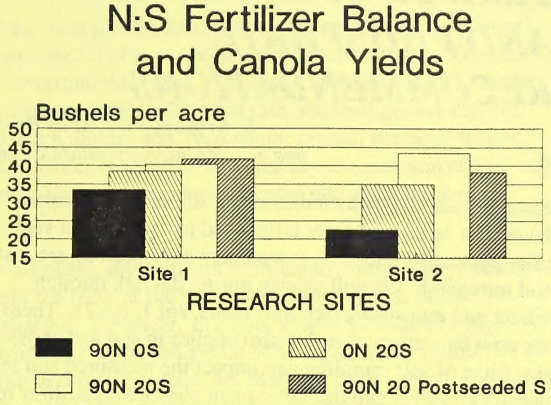
Elston Solberg
Soils Branch

Results from the first year of a research project cooperatively funded by the Alberta Canola Growers Commission and the Alberta Agriculture Research Institute highlight the importance of nitrogen and sulphur balance in canola production. It has been known for some time that fertilizer nitrogen added to soils very deficient in plant available sulphur (< 5 lbs/ac SO_4-S) will often result in lower canola yields than if no nitrogen were added at all.

The same is true for cereals but since canola has a much higher S requirement; about 2 times that of wheat; the incidence and severity of this problem is much greater with canola. First year results (see figure) from two sites that were moderately deficient in plant available S (12-14 lbs/ac SO_4-S) showed yield reductions of 6 to 21 bushels when N fertilizer was applied by itself compared to the S fertilizer treatment or the N and S treatment respectively. This kind of yield loss can make or break an operation in today's tough times.

Interestingly, S fertilizer applied after seeding but before bolting allowed the crop to recover almost completely in term of yield and quality. This means that a producer has a window of several weeks after seeding in which to correct a S deficiency or an induced N:S imbalance.

Why are the yields of canola grown on S deficient land sometimes depressed by N fertilizer applications? Len Kryzanowski, Crops Nutrition Agronomist, offered "The scientific literature suggests at least three possible explanations: First, additions of N can stimulate increased growth of



soil organisms that tie up some of the plant available S thereby reducing what is available to the crop. Second, because S is required for protein synthesis, there can be a buildup of toxic nitrogenous compounds in the plant when the supply of soil plant available S is exhausted. Third, relatively large amounts of plant available N can cause lush growth at an early stage which can tie up the available S so that none is available for seed set. I suspect that all 3 factors are at play in most situations."

The key to an efficient fertilizer program is for canola producers to know the S status of their soils and to apply N and S fertilizers at the recommended 7:1 to 10:1 ratio when they know their soil is S deficient. Or as Ieuan Evans, Crop Pathologist puts it, "Soil testing is important but for producers that do not regularly soil sample, $2 to $4 of S fertilizer is cheap insurance when you consider the potential profit loss even when today's canola is worth $5 or less!"

John and Fred were just crazy about baseball, and both were curious to know if it was played in heaven. They made a vow that if one should die before the other, he would return to earth and tell the other if there was baseball in heaven. One day Fred died. Being the good person that he was he went to heaven. Three weeks later John was walking down the street when he felt a tap on the shoulder. He turned around but could see no one. Suddenly he heard a voice,

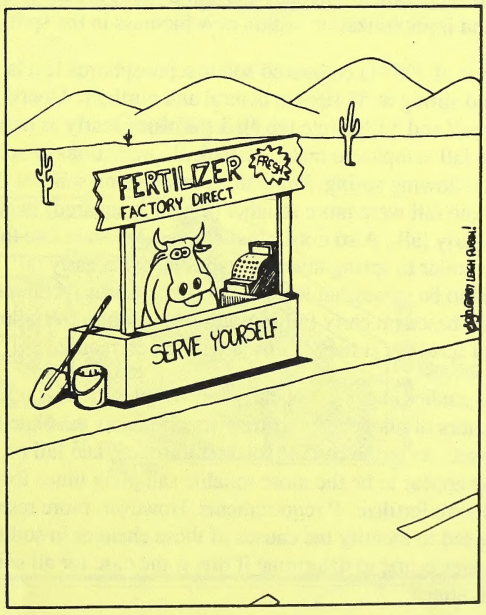
"John it's me Fred."

"Hey, Fred. Tell me, is there baseball in heaven?"

"I've got some good news and bad news. First, the good news. Yes John there is baseball in heaven."

"That's great Fred, but what's the bad news?"

"You're pitching Friday."



TIME OF SOIL SAMPLING AND PHOSPHATE RECOMMENDATIONS

L. Kryzanowski , Soils Branch and S.S. Malhi, Agriculture Canada

Recent research results indicate that soil test phosphorus levels can be significantly influenced by time of soil sampling. Since the late 70's, researchers have been aware that soil nitrogen levels will change during the fall, through winter and into spring (see Soilutions Vol.1, No.2). There are now indications that this also applies to soil test phosphorus. Time of soil sampling can impact the measured soil test phosphorus level and the subsequent phosphate fertilizer recommendations.

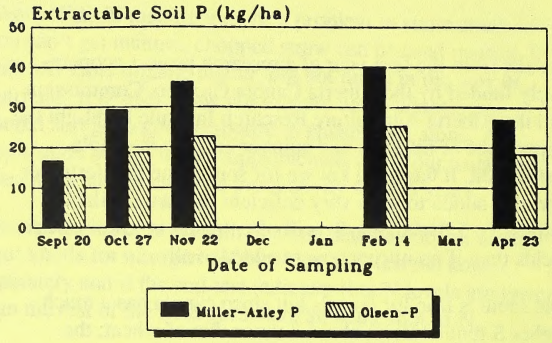
Historically, the calibration of the phosphorus soil test is based on field research with spring soil sampling. However, the majority of producer soil sampling is done in the fall to allow for fall application of fertilizer and reduce spring workload. Until now it has been assumed that soil test phosphorus levels would not differ significantly from fall to spring, but recent research results indicate that this assumption is not valid.

Nyborg et al. (1991) measured phosphorus changes at three sites in central Alberta over the fall-winter-spring interval using several soil tests. They noted that extractable phosphorus levels increased from early (Sept.) to late (Nov.) fall. Levels continued to rise through the winter and then decreased after the soil had thawed in spring. The trend was the same for all extractants. Figure 1 illustrates the changes in phosphorus levels at the Ellerslie site for two of the soil tests commonly used in western Canada. The authors suggested that the changes in extractable phosphorus may be the result of mineralization of biomass and soil organic matter in the fall, and immobilization within new biomass in the spring.

Malhi et al. (1991) compared soil test phosphorus levels in fall and spring at 53 sites in central and northern Alberta. Figures 2 and 3 illustrate the effect of using early as opposed to late fall samples to make statistical predictions of soil test P the following spring. Predictions made using soil test data from late fall were more reliable (higher R squared) than from early fall . Also notice that soil test levels in late fall are very similar to spring levels whereas levels in early fall tended to be somewhat lower. Thus phosphorus recommendations based on early fall samples can result in overapplication of fertilizer if they are used without correction.

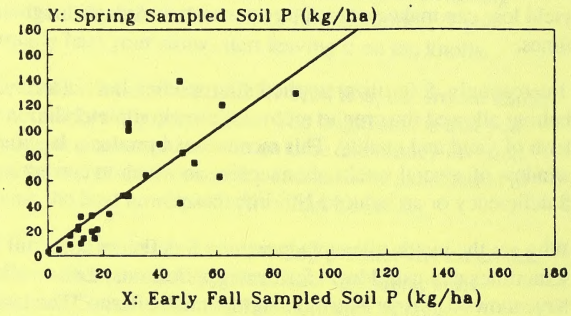
These studies suggest that early fall samples are less reliable indicators of phosphate fertilizer requirements than late fall samples. As in the case of soil test nitrogen, late fall or spring appear to be the more reliable sampling times for predicting fertilizer P requirements. However, more research is needed to identify the causes of these changes in soil test phosphorus and to determine if this is the case for all soils in the province.

Fig 1. Change in extractable P from fall to spring at Ellerslie



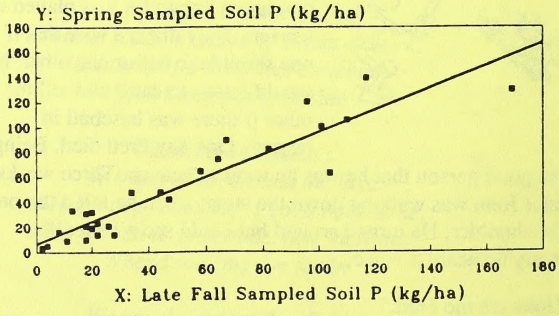
Nyborg et al. (1991)

Fig 2. Correlation between early fall and spring extractable soil P



Malhi et al. (1991)
Y = 5.31 + 1.59X R2 = 0.67**
27 sites

Fig 3. Correlation between late fall and spring extractable soil P



Malhi et al. (1991)
Y = 6.67 + 0.89X R2 = 0.87**
27 sites

Nyborg, M., S.S. Malhi, J.A. Robertson, and M. Zhang. 1991. Changes in extractable P in Alberta soils during the fall-winter-spring interlude. Commun. Soil Sci. Plant Anal. (In Press).

Malhi, S.S., M. Nyborg, L. Kryzanowski, K.S. Gill, and M.A. Arshad. 1991. Changes in extractable P between fall and spring in some Alberta soils. Commun. Soil Sci. Plant Anal. (In Press).

TOPSOIL LOSS FROM BLACK AND GRAY WOODED SOILS

Elston Solberg
Soils Branch

We all know that when topsoil is lost to wind or water erosion that crop yields decline. But by how much?? .... and .....Can one recover the losses??

To answer these questions, Agriculture Canada, University of Alberta, and Alberta Agriculture established 6 longterm experiments across Alberta in 1990. Agriculture Canada (Lethbridge) initiated 4 sites on dryland and irrigated brown soils in the spring of 1990 while Black (Josephburg) and Gray Wooded (Cooking Lake) sites were started last fall by U of A and Soils Branch .

To simulate erosion, incremental depths of topsoil were mechanically removed (scalped), to give the main experimental treatments of 0, 5, 10, 15 and 20 centimeters (cm) of topsoil erosion. The study is also evaluating whether soil productivity can be restored by adding nitrogen and phosphorous fertilizer, cattle manure or 5 cm of topsoil. All sites will be cropped to spring wheat for the duration of the experiment. For the central Alberta sites, the first year yields of Roblin (see figure) lead to a number of observations:

- The top yields, 77 bu/ac (Josephburg) and 73 bu/ac (Cooking Lake), indicate excellent growing conditions and experimental procedure. Many tour visitors commented on the vigorous, even, weed free stand and the actual yields surpassed the most optimistic projections.

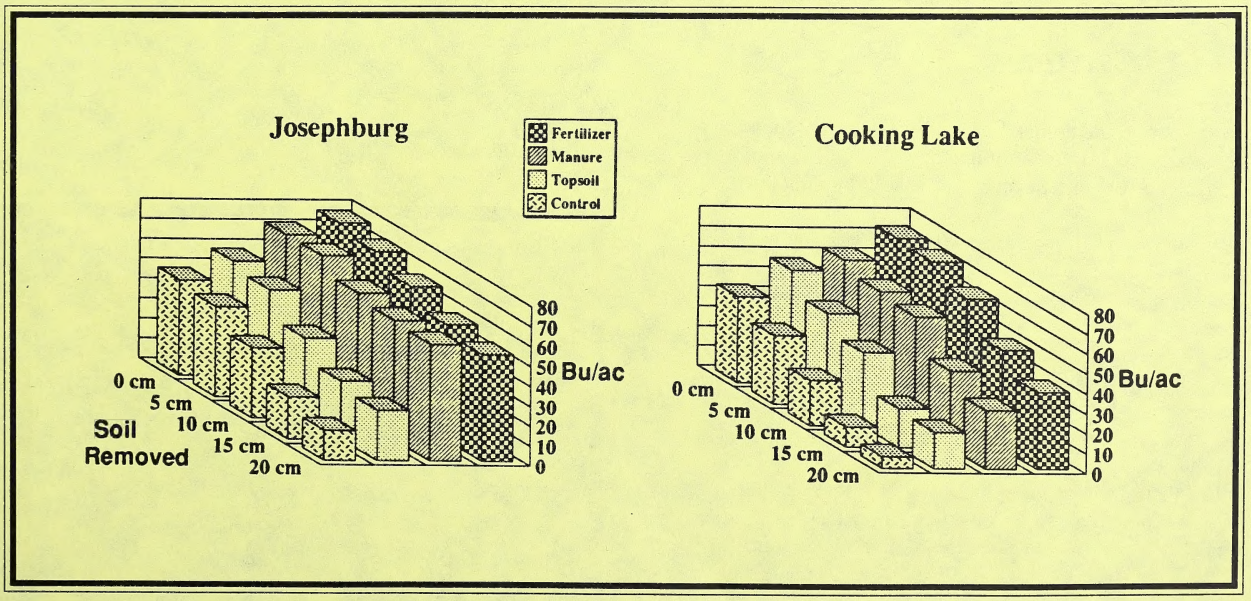
- Soil erosion dramatically reduces yield. "This is especially true with the Cooking Lake soil since there is only 10 to 12 cm of rather cruddy topsoil to begin with," stated Marvin Nyborg (U of A cooperative researcher), "while the yield reduction at the Josephburg site was somewhat surprising since there's 25 to 30 cm of Alberta's best soil there!"

- Erosion greatly limits management options. As Ceasar Izaurralde (U of A cooperative researcher) put it, "One can not overstate this point. As topsoil is removed, tilth, water holding capacity, infiltration rate, seedbed quality etc. etc. are much diminished. As a result, the soil becomes wetter, drier, harder etc. much more quickly than the non eroded soil and management windows become narrower and more costly."

- All of the amendments significantly improved yields but could not recover the full production potential of the non eroded soil. Fertilizer, 112 lb/ac N and 34 lb/ac of P_2O_5, consistently increased yields 30 to 40 bu/ac no matter the depth of erosion or location. Manure, 34 tons/ac dry weight basis, markedly increased yields and was especially beneficial on the more deeply eroded soils where it had a positive effect on soil tilth and seedbed quality. Topsoil return was also quite effective in restoring productivity and greatly improved tilth and seedbed quality on the highly eroded treatments.

It is obvious from these preliminary results that there are no quick fixes for eroded soils. Much can be done with individual amendments and there is much potential for combinations of amendments and intelligent agronomic management. The key, of course, is to do as much as possible to minimize or eliminate conditions that permit wind and/or water erosion. The initial results are exciting and lead to a number of new questions that will hopefully be answered over the next few years.

For more information call Elston Solberg (427-2530), Ceasar Izaurralde (492-3242), Marvin Nyborg (492-3242) or Frank Larney (327-4561).



SOIL SEARCHING

PRODUCTION EFFICIENCY LOST IN THE SMOKE

In the last issue of SOILutions, I posed the question, "When the sustainability and environmental smoke clears, will we still be able to compete?" But, before jumping off that particular cliff, let me first clarify my position. I don't wish to imply that all sustainability and environmental issues are smoke and mirrors, but the pendulum of human endeavor does tend to swing to the extremes. Living and working most of my career in a country, where food is abundant and cheap relative to income, and having occasional opportunities to travel and work in developing countries, where food is expensive and often scarce has allowed me to make the following observation: I have never met an environmentalist in a food queue. They seem to evolve and proliferate in an environment of cheap and abundant food.

There is a real need to address environmental issues, but this does not lessen the need to address food production. Environmental problems are as much social as technical problems and their solution, in a global perspective, is dependent on a well fed and well educated population. If population continues to increase and we pay inadequate attention to food production and production efficiency, we will all end up in the food queue without a single environmentalist among us.

Getting back to environmental and sustainability problems in Western Canada, the main issue was and continues to be soil degradation through wind and water erosion, salinization, and loss of organic matter. The main culprits were and continue to be summerfallow and excessive tillage. But, to the vast majority of the public, the issue is no longer clear and well defined because the list of perceived problems now includes almost all agricultural practices. Keeping initiatives aimed at combatting soil degradation on line is becoming increasingly difficult as the target becomes obscured by the smoke of misrepresentation. A good example was the March episode of David Suzuki's "Nature of Things" on CBC. The footage showed scene after scene of soil erosion on excessively tilled fallow while the accompanying verbiage expounded on the devastating effects of agricultural chemicals. I am sure that many viewers came away with the impression that chemical use caused erosion.

If the main causes of soil degradation are summerfallow and excessive tillage, the solution seems obvious. However, simply reducing the frequency of fallow and tillage hasn't often resulted in efficient and profitable cropping systems. Studies of reduced fallow and tillage systems have and are yielding useful information but we are still a long way from delivering production systems that optimize the use of crop, soil, and climate resources in a sustainable manner. In the past, the approach has been to address soil degradation or conservation as issues independent and apart from production, when they are in fact strongly interrelated and often complimentary. Soil/crop management systems that optimize the use of soil and climate resources from a productivity perspective will often solve degradation problems. Unfortunately, there has only been a very limited commitment of resources to research that simultaneously addresses degradation and production issues.

Douglas C. Penney
Soils Branch

KEEP IT SIMPLE

Don't complicate things. Keep any task, action, or issue in perspective. See it for what it actually is. Do not assign significance or consequences to it that it does not have.

If, when you tied your shoes in the morning, you were thinking about every pair of shoes you'd ever owned, all the shoes you will own in future, the repairs, maintenance, total cost of a lifetime of shoes, the matching of shoes to clothes, the running you've done in them and will do in them, the parties you've gone to and will go to in them, and all the rest, you'd drive yourself crazy with enormity and significance of it - when all your really doing is tying your shoes.

When you start to grow agitated over a task or situation, stop. Take a couple of deep breaths. Recognize that what you've probably begun to do is attach a whole baggage train of significance and consequence to it. Uncouple the baggage train and keep it simple. Let a task or situation be its own separate self. Reduce it to what it actually is.

Jerry Mundis

SOILutions is published quarterly by Soils Branch, Alberta Agriculture. Your comments on current contents, ideas and contributions for future articles are welcome. For further information phone, fax, or write *Dan Heaney*, Soil and Animal Nutrition Laboratory, 905 O.S. Longman Bldg., 6909-116 st, Edmonton, Alberta, T6H 4P2, Phone (403)427-6361, Fax (403) 427-1439 **OR** *Elston Solberg*, Soils Branch, J.G. O'Donoghue Bldg., 7000-113 st, Edmonton, Alberta, T6H 5T6. Phone (403) 427-2530, Fax (403) 422-9745.